

# Hot Sun

## 6 Week STEM Clubs



### Aim

*Children are introduced to the challenges facing spacecraft engineers regarding the need to keep instruments cool whilst orbiting the sun*

## Introduction

Out of the billions of stars that exist in our galaxy the sun is closest, and in order to unravel its mysteries engineers have designed the Solar Orbiter space probe. Its mission: to take unprecedented close-up observations of the sun from closer than any spacecraft has ever been before.

Solar Orbiter will need to keep all its electronic scientific instruments working whilst being subjected to extreme temperatures of up to 500 degrees Celsius – this will be over 13 times hotter than any of our satellites in Earth's orbit.

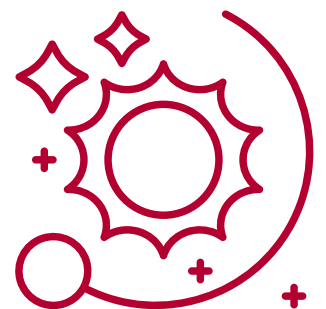
### Equipment

- ◉ Chocolate
- ◉ Stiff card
- ◉ Tin foil
- ◉ Cotton wool
- ◉ Hair dryer
- ◉ Polystyrene beads

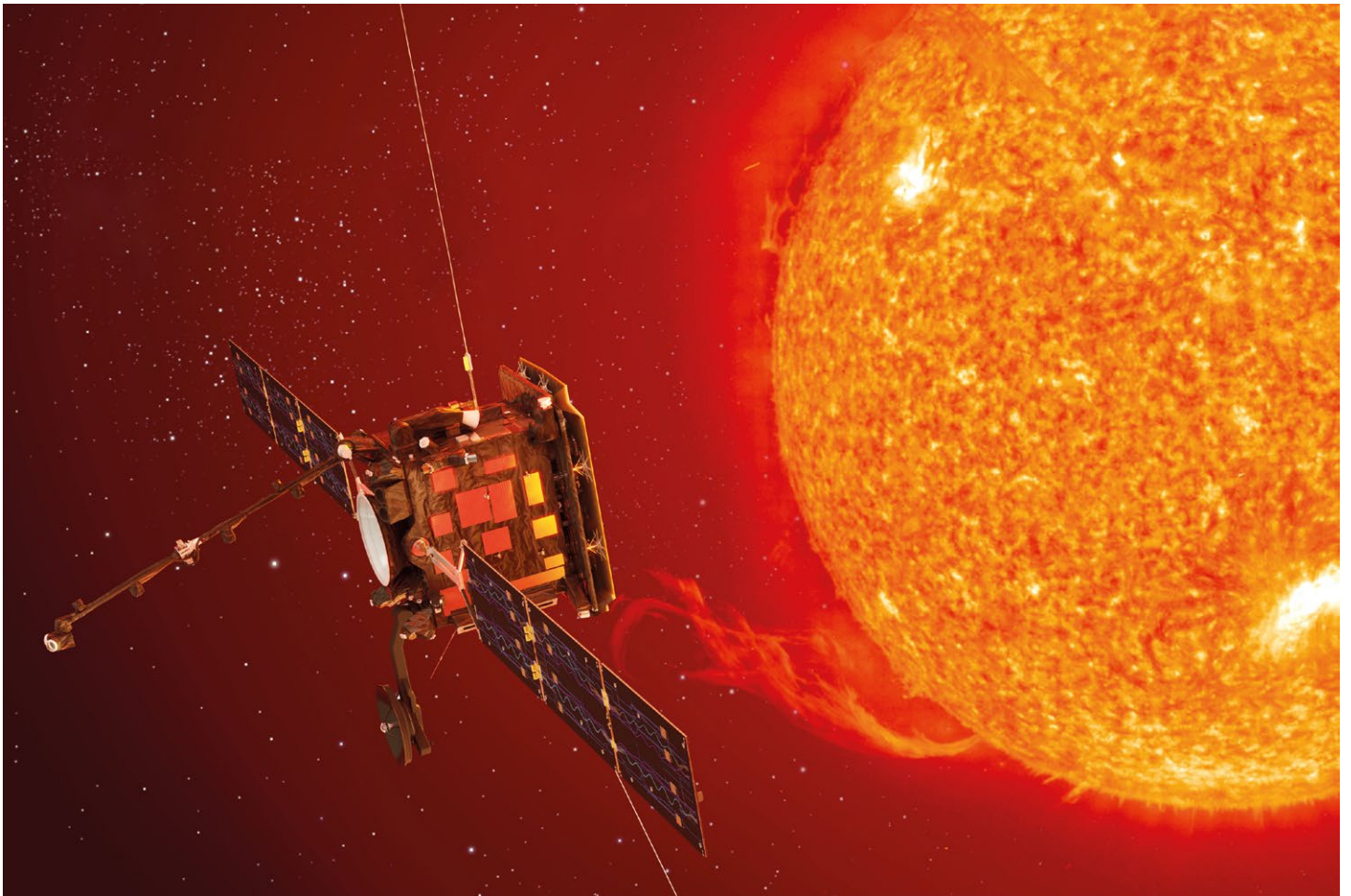
### Instructions

- 1 In your teams, first make a small box from stiff card, this will be your space probe; a small square of chocolate will be your instrument payload. Now think about which materials will protect your instrument payload from the 'hair dryer heat source'
- 2 Sketch out several designs, then build and test your prototypes by using, under supervision, the 'hair dryer heat source' with a set duration and distance
- 3 Think about whether your chosen materials should be good conductors or insulators and whether to use several types. Remember that some materials are better at reflecting heat away. Also, spacecraft engineers do use Multi-Layer Insulation to reduce heat absorption as well as thermal straps to conduct heat away from hot locations to cold ones
- 4 Remember the need to experiment: (i.e.) test, fail, evaluate and redesign – this is part of engineering. Also, chocolate melts at body temperature, and milk chocolate will melt faster than dark chocolate because it has a higher fat content
- 5 Finally, as designs improve, consider increasing the heat blast duration

Activity



In association with



## Useful links

- ◉ Solar Orbiter Mission <https://tinyurl.com/52ekjgj1>
- ◉ Thermal Straps <https://tinyurl.com/1ewv8ohk>
- ◉ Multi-Layer Insulation <https://tinyurl.com/1hra794f>



## Next steps

- ◉ Make a presentation explaining your designs, highlighting what worked well and what didn't
- ◉ Conduction, radiation, and convection are the 3 ways that heat energy gets transferred. Do your own independent research into how they differ